Advanced Radioisotope Power Systems

Background

The Department of Energy and its predecessors have provided radioisotope power systems for use in space exploration for more than 35 years. These systems have been proven safe, reliable, and maintenance free, and are capable of producing either heat or electricity for decades under the harsh conditions experienced in deep space. A radioisotope power system converts the heat from the decay of the radioactive isotope plutonium-238 (a type of plutonium that is not useable for nuclear weapons) into electricity, which is needed to power a spacecraft. These systems are ideal for applications where solar panels cannot supply adequate power—such as for spacecraft surveying planets far from the sun such as the Galileo mission to Jupiter and the Cassini mission recently launched to Saturn. In addition to radioisotope power systems, the Department provides radioisotope heater units (RHUs) for space use. These RHUs use the heat generated by plutonium-238 to keep a spacecraft's instruments warm and within their designed operating temperatures. The Pathfinder rover launched in late 1996 as a part of the Mars Explorer mission uses these units to stay warm during the cold Martian nights.

In October 1997, NASA launched the Cassini mission to the planet Saturn. The Cassini spacecraft that uses DOE supplied radioisotope thermoelectric generators (RTGs) is the largest spacecraft ever launched to explore the outer planets. It will study the planet Saturn and its surrounding moons using a broad range of scientific instruments. This mission is enabled by the use of RTGs because of the large distance from the sun.

NASA has identified several potential new missions that may require radioisotope power systems and heaters. New RHUs may be needed on several missions beginning as early as 2001, with some missions requiring several RHUs per spacecraft. An advanced radioisotope power system that is more efficient and will require less fuel is being developed to meet the performance requirements of potential missions in the 2003-2006 timeframe. Each mission will require support from the Department in preparing the safety analysis report and in supporting NASA's request for launch approval.

The Department is also conducting technology development of innovative advanced technologies that may enable smaller and more efficient systems available for future space exploration applications.

FY 1999 Major Activities/Planned Accomplishments:

- Fabricated a test model of the advanced, high-efficiency radioisotope power system for future NASA outer planetary exploration missions.
- Continued evaluation, development and implementation of options for providing near-term and long-term supply of Pu-238.
- Maintained operational capability of DOE program facilities to produce radioisotope power systems for current and future missions.

FY 2000 Planned Accomplishments:

- Complete system final design and initiate fabrication of qualification unit of the advanced, high-efficiency radioisotope power system for future NASA outer planetary exploration missions.
- Complete evaluation and Environmental Impact Statement with Record of Decision concerning development of a domestic Pu-238 production capability for a long-term, reliable supply of Pu-238.
- Prepare RHUs for shipment to launch site and support NASA in the launch approval process for the Mars Surveyor 2001 mission.
- Maintain operational capability of DOE program facilities and fabricate Pu-238 fueled clads and heat source modules for the next NASA space exploration missions potentially requiring the advanced radioisotope power system; such as the Europa Orbiter and Pluto/ Kuiper Express missions scheduled for launch in 2003 and 2004, respectively.

Program Budget
(in millions)

FY 1998 Appropriation	FY 1999 Appropriation	FY 2000 Request
$40.0	$37.0	$37.0